

Claims

What is claimed is:

1. In filters fabricated on a birefringent electrooptic substrate, a tunable electrooptic add-drop filter apparatus, the apparatus comprising:

- (a) two input single mode waveguides;
- (b) a first beam splitter connected to said waveguides;
- (c) a polarization converter connected to each of said waveguides after said first beam splitter wherein each said polarization converter includes more than one set of spaced apart, spatially periodic, strain-inducing pads;
- (d) electrodes in proximity to each said polarization converter;
- (e) a second beam splitter connected to said waveguides after said polarization converter; and
- (f) two output single mode waveguides connected to said second beam splitter.

2. The apparatus of claim 1 wherein the length of said polarization converter is given by:

$$L_{tot} = N_c L_1 + (N_c - 1) L_2$$

where:

N_c = an integral number of polarization coupling regions of length L_1 and

L_2 = longer regions between said polarization coupling regions in which polarization coupling does not occur.

- 1 3. The apparatus of claim 2 further comprising a plurality of individual strain-inducing pads
2 wherein the spacing between any two such strain-inducing pads is equal to an integer times
3 a particular minimum spacing between adjacent strain-inducing pads.
4
- 5 4. The apparatus of claim 3 wherein widths of the strain-inducing pads are varied.
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- 7 5. The apparatus of claim 4 wherein said polarization converter has a center and edges and
8 wherein the width of said strain-inducing pads is greater at the center of said polarization
9 converter and tapers monotonically toward said edges.
10
- 11 6. The apparatus of claim 1 further comprising polarization maintaining fibers connected to
12 each input and output single mode waveguide.
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- 14 7. The apparatus of claim 1 further comprising a plurality of said tunable electrooptic add-
15 drop filters in series.
16
- 17 8. The apparatus of claim 7 wherein said plurality of tunable electrooptic add-drop filters
18 have different values of N_c where N_c is an integral number of polarization coupling
19 regions.
20
- 21 9. The apparatus of claim 1 further comprising a voltage tuner connected to said electrodes.
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1 10. In filters fabricated on a birefringent electrooptic substrate, a tunable electrooptic add-drop
2 filter apparatus, the apparatus comprising:

- 3 (a) two input/output single mode waveguides;
4 (b) a beam splitter connected to the waveguides;
5 (c) a polarization converter connected to each of said waveguides wherein the
6 polarization converter includes more than one set of spaced apart spatially periodic,
7 strain-inducing pads;
8 (d) electrodes on the substrate in proximity to each polarization converter; and
9 (e) a reflector connected to the waveguides after the polarization converter.

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11 11. The apparatus of claim 10 wherein the length of the polarization converter is given by:

$$L_{tot} = N_c L_1 + (N_c - 1) L_2$$

12
13 where:

14 N_c = an integral number of polarization coupling regions of length L_1 and

15 L_2 = longer regions between said polarization coupling regions in which
16 polarization coupling does not occur.

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18 12. The apparatus of claim 11 further comprising a multiplicity of individual strain-inducing
19 pads wherein the spacing between any two such strain-inducing pads is equal to an integer
20 times a particular minimum spacing between adjacent strain-inducing pads.

21
22 13. The apparatus of claim 12 wherein widths of the strain-inducing pads are varied.

1 14. The apparatus of claim 13 wherein said polarization converter has a center and edges and
2 wherein the width of said strain-inducing pads is greater at the center of said polarization
3 converter and tapers monotonically toward said edges.

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5 15. The apparatus of claim 10 further comprising a voltage tuner connected to the electrode.

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7 16. The apparatus of claim 10 further comprising polarization maintaining fibers connected to
8 each input/output single mode waveguide.

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10 17. The apparatus of claim 10 further comprising an optical circulator connected to each said
11 input/output waveguide.

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13 18. In filters fabricated on a birefringent electrooptic substrate, a tunable electrooptic add-drop
14 filter method, the method comprising the steps of:

- 15 (a) providing two input single mode waveguides on said substrate;
- 16 (b) connecting a first beam splitter to said waveguides;
- 17 (c) connecting a polarization converter to said waveguides after said first beam splitter
18 wherein said polarization converter is conformed to include more than one set of
19 spaced apart, spatially periodic, strain-inducing pads;
- 20 (d) connecting electrodes to said polarization converter;
- 21 (e) connecting a second beam splitter to said waveguides after said polarization
22 converter;

- (f) connecting two output single mode waveguides to said second beam splitter;
- (g) connecting a voltage tuner to said electrodes; and
- (h) applying a voltage to said electrodes through said voltage tuner.

19. The method of claim 18 further comprising the step of forming the length of said polarization converter in accordance with the formula:

$$L_{tot} = N_c L_1 + (N_c - 1) L_2$$

where:

N_c = an integral number of polarization coupling regions of length L_1 and

L_2 = longer regions between said polarization coupling regions in which polarization coupling does not occur.

20. The method of claim 19 further comprising the step of connecting a plurality of said tunable electrooptic add-drop filters in series.

21. The method of claim 19 further comprising the step of replacing step (e) with the step of adding a reflector to said waveguides after said polarization converter.